What is claimed is:

1. An optical system for use in an optical pickup apparatus, comprising:

an expander lens including at least two lens groups and to convert a diameter of a light flux; and

an objective lens to converge the light flux from the expander lens;

wherein the following formula is satisfied:

$W1_{CM} > W2_{CM}$

where $W1_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of a wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by an arbitrary distance Y1 (mm) not larger than 0.05 (mm) comes into the objective lens, and

$W2_{CM}$ is a coma aberration (λrms) of a converged spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by the arbitrary distance Y1 (mm) comes through the expander lens into the objective lens on a condition that the optical axis

of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

2. The optical system of claim 1, wherein the following formula is satisfied:

$$H2 > H1$$

where $\pm H1$ (mm) ($H1 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes into the objective lens, and

$\pm H2$ (mm) ($H2 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes through the expander lens into the objective lens on the condition that the optical axis of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

3. The optical system of claim 1, wherein the following formula is satisfied:

$$|(W3_{CM} - W4_{CM}) / W3_{CM}| < 0.5$$

where $W3_{CM}$ is a coma aberration (λrms) of a converged light spot when an axial light flux of the wavelength λ (nm) comes through the expander lens into the objective lens and Y2 is a distance (mm) measured in a vertical direction from the optical axis to the converged light spot on a condition that the optical axis of an arbitrary lens group among the lens groups constructing the expander lens is arranged to conform with the optical axis of the objective lens and the lens group except the arbitrary lens is arranged to shift in a vertical direction from the optical axis by an arbitrary distance Δ(mm) not larger than 0.1 (mm), and

$W4_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis by the distance Y2 (mm) comes through the expander lens into the objective lens on a condition that the optical axis of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

4. The optical system of claim 1, wherein the expander lens comprises at least one aspherical surface.

5. The optical system of claim 1, wherein the numerical aperture of the objective lens is 0.8 or more and the expander lens changes an incident angle of a marginal ray of a light flux coming into the objective lens by changing a distance among the lens groups constructing the expander lens.

6. The optical system of claim 1, wherein the objective lens comprises at least two lens groups.

7. The optical system of claim 1, wherein the total length of the expander lens measured on the optical axis is 3 mm or less.

8. The optical system of claim 1, wherein a magnification γ of the expander lens satisfies the following formula:

$$\gamma = D2/D1 > 1.2$$

where D1 is a diameter (mm) of a light flux coming into the expander lens, and

D2 is a diameter (mm) of the light flux going out from the expander lens.

9. An optical pickup apparatus, comprising:

a light source to emit a light flux of a wavelength λ (nm); and

an optical system to converge the light flux emitted from the light source onto an information recording plane of an optical information recording medium so that the optical pickup apparatus conducts recording and/or reproducing information, the optical system including

an objective lens located opposite to an optical information recording medium, and

an expander lens provided between the light source and the objective lens and including at least two lens groups;

wherein at least one lens group among the lens groups constructing the expander lens is structured to be shiftable in the optical axis direction and the shiftable lens group is shifted in the optical axis direction to change a distance among the lens groups constructing the expander lens in such a way that a spherical aberration correction is conducted for a converged light spot on the information recording plane;

wherein the following formula is satisfied:

$\ddot{W}1_{CM} > \ddot{W}2_{CM}$

Where $W1_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by an arbitrary distance Y1 (mm) not larger than 0.05 (mm) comes into the objective lens, and

$W2_{CM}$ is a coma aberration (λrms) of a converged spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by the arbitrary distance Y1 (mm) comes through the expander lens into the objective lens on a condition that the optical axis of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

10. The optical pickup apparatus of claim 9, wherein the following formula is satisfied:

$$H2 > H1$$

Where $\pm H1$ (mm) ($H1 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes into the objective lens, and

$\pm$H2 (mm) (H2 > 0) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes through the expander lens into the objective lens on the condition that the optical axis of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

11. The optical pickup apparatus of claim 9, wherein the following formula is satisfied:

$$| (W3_{CM} - W4_{CM}) / W3_{CM} | < 0.5$$

where $W3_{CM}$ is a coma aberration (λrms) of a converged light spot when an axial light flux of the wavelength λ (nm) comes through the expander lens into the objective lens and Y2 is a distance (mm) measured in a vertical direction from the optical axis to the converged light spot on a condition that the optical axis of an arbitrary lens group among the lens groups constructing the expander lens is arranged to conform with the optical axis of the objective lens and the lens group except the arbitrary lens is arranged to shift in a vertical direction from the optical axis by an arbitrary distance Δ(mm) not larger than 0.1 (mm), and

$W4_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis by the distance Y2 (mm) comes through the expander lens into the objective lens on a condition that the optical axis of all lens groups constructing the expander lens is arranged so as to conform with the optical axis of the objective lens.

12. The optical pickup apparatus of claim 9, wherein the expander lens comprises at least one aspherical surface.

13. The optical pickup apparatus of claim 9, wherein the numerical aperture of the objective lens is 0.8 or more.

14. The optical pickup apparatus of claim 9, wherein the objective lens comprises at least two lens groups.

15. The optical pickup apparatus of claim 9, wherein the total length of the expander lens measure on the optical axis is 3 mm or less.

16. The optical pickup apparatus of claim 9, wherein a magnification γ of the expander lens satisfies the following formula:

$$\gamma = D2/D1 > 1.2$$

where D1 is a diameter (mm) of a light flux coming into the expander lens, and

D2 is a diameter (mm) of the light flux going out from the expander lens.

17. An optical information recording reproducing apparatus, comprising:

the optical pickup apparatus described in claim 9, and

a supporting device to support an optical information recording medium at a position where recording and/or reproducing information is conducted for the optical information recording medium by the optical pickup apparatus.

18. An optical system for use in an optical pickup apparatus, comprising:

a coupling lens to change a divergent angle of an incident light flux; and

an objective lens to converge the light flux from the coupling lens;

wherein the following formula is satisfied:

$W1_{CM} > W2_{CM}$

where $W1_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of a wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by an arbitrary distance Y1 (mm) not larger than 0.05 (mm) comes into the objective lens, and

$W2_{CM}$ is a coma aberration (λrms) of a converged spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by the arbitrary distance Y1 (mm) comes through the coupling lens into the objective lens on a condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

19. The optical system of claim 18, wherein the following formula is satisfied:

$H2 > H1$

where $\pm H1$ (mm) ($H1 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes into the objective lens, and

$\pm H2$ (mm) ($H2 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes through the coupling lens into the objective lens on the condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

20. The optical system of claim 18, wherein the following formula is satisfied:

$$|(W3_{CM} - W4_{CM}) / W3_{CM}| < 0.5$$

where $W3_{CM}$ is a coma aberration (λrms) of a converged light spot when an axial light flux of the wavelength λ (nm) comes through the coupling lens into the objective lens and Y2 is a distance (mm) measured in a vertical direction from the optical axis to the converged light spot on a condition that the coupling lens is arranged to shift in a vertical

direction from the optical axis by an arbitrary distance Δ (mm) not larger than 0.1 (mm), and

$W4_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis by the distance Y2 (mm) comes through the coupling lens into the objective lens on a condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

21. The optical system of claim 18, wherein the coupling lens comprises at least one aspherical surface.

22. The optical system of claim 18, wherein the numerical aperture of the objective lens is 0.8 or more and the coupling lens changes an incident angle of a marginal ray of a light flux coming into the objective lens by changing a distance to the objective lens.

23. The optical system of claim 18, wherein the objective lens comprises at least two lens groups.

24. The optical system of claim 18, wherein the absolute value of the ratio of the numerical aperture of the coupling lens to the numerical aperture is 0.1 or more and the following formula is satisfied:

$$| NA_{CUP} / NA_{OBJ} | > 0.1$$

where NA_{CUP} is the numerical aperture of the coupling lens, and NA_{OBJ} is the numerical aperture of the objective lens.

25. An optical pickup apparatus, comprising:

a light source to emit a light flux of a wavelength λ (nm); and

an optical system to converge the light flux emitted from the light source onto an information recording plane of an optical information recording medium so that the optical pickup apparatus conducts recording and/or reproducing information, the optical system including

an objective lens located opposite to an optical information recording medium, and

a coupling lens provided between the light source and the objective lens and to change a divergent angle of a divergent light flux emitted from the light source;

wherein the coupling lens is structured to be shiftable in the optical axis direction and the coupling lens is shifted in the optical axis direction to change a distance to the objective lens in such a way that a spherical aberration correction is conducted for a converged light spot on the information recording plane;

wherein the following formula is satisfied:

$W1_{CM} > W2_{CM}$

Where $W1_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by an arbitrary distance Y1 (mm) not larger than 0.05 (mm) comes into the objective lens, and

$W2_{CM}$ is a coma aberration (λrms) of a converged spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis of the objective lens by the arbitrary distance Y1 (mm) comes through the coupling lens into the objective lens on a condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

26. The optical pickup apparatus of claim 25, wherein the following formula is satisfied:

$$H2 > H1$$

Where $\pm H1$ (mm) ($H1 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes into the objective lens, and

$\pm H2$ (mm) ($H2 > 0$) is a range of image height within which the coma aberration of a converged light spot becomes less than 0.07 (λrms) when an off-axial light flux of the wavelength λ (nm) comes through the coupling lens into the objective lens on the condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

27. The optical pickup apparatus of claim 25, wherein the following formula is satisfied:

$$| (W3_{CM} - W4_{CM}) / W3_{CM} | < 0.5$$

where $W3_{CM}$ is a coma aberration (λrms) of a converged light spot when an axial light flux of the wavelength λ (nm) comes through the coupling lens into the objective lens and Y2 is a

distance (mm) measured in a vertical direction from the optical axis to the converged light spot on a condition that the coupling lens is arranged to shift in a vertical direction from the optical axis by an arbitrary distance Δ (mm) not larger than 0.1 (mm), and

$W4_{CM}$ is a coma aberration (λrms) of a converged light spot when an off-axial light flux of the wavelength λ (nm) emitted so as to converge at a position distant in a vertical direction from the optical axis by the distance Y2 (mm) comes through the coupling lens into the objective lens on a condition that the optical axis of the coupling lens is arranged so as to conform with the optical axis of the objective lens.

28. The optical pickup apparatus of claim 25, wherein the coupling lens comprises at least one aspherical surface.

29. The optical pickup apparatus of claim 25, wherein the numerical aperture of the objective lens is 0.8 or more.

30. The optical pickup apparatus of claim 25, wherein the objective lens comprises at least two lens groups.

31. The optical pickup apparatus of claim 25, wherein the absolute value of the ratio of the numerical aperture of the coupling lens to the numerical aperture is 0.1 or more and the following formula is satisfied:

$$| NA_{CUP} / NA_{OBJ} | > 0.1$$

where NA_{CUP} is the numerical aperture of the coupling lens, and NA_{OBJ} is the numerical aperture of the objective lens.

32. An optical information recording reproducing apparatus, comprising:

the optical pickup apparatus described in claim 25, and

a supporting device to support an optical information recording medium at a position where recording and/or reproducing information is conducted for the optical information recording medium by the optical pickup apparatus.